MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2019/2020

EEM1016 – ENGINEERING MATHEMATICS I
(ME/ RE / TE)

14 OCTOBER 2019

9.00 a.m. – 11.00 a.m.

(2 Hours)

INSTRUCTIONS TO STUDENT

1.This Question paper consists of 4 pages (including cover page) with 5 Questions only.

2. Attempt **ALL**questions. The distribution of the marks for each question is given.

3. Please writeall your answers in the answer booklet provided.

Question 1

(a) Evaluate $\lim_{x\to 2}\dfrac{\sin(x-2)}{2x^2-4x}$ [3 marks]

(b) Evaluate the following integrals.

(i) $\displaystyle\int_0^1 \frac{1}{(2x+1)(x+3)}\,dx$ [5 marks]

(ii) $\displaystyle\int \frac{2x^2}{3x^3-1}\,dx$ [5 marks]

(c) Find the local extreme values of the following function:
$f(x)=3x^4+2x^3-9x^2+1$ [7 marks]

Question 2

A periodic function $f(x)$ is defined within the period $-1 < x < 1$ by

$$f(x)=\begin{cases}4 & (-1<x<0)\\ -4 & (0<x<1)\end{cases}$$
$$f(x+2)=f(x)$$

(a) Sketch a graph of $f(x)$ for $-4 < x < 4$. [3 marks]

(b) Is $f(x)$ an even or odd function or neither? Explain your answer. [2 marks]

(c) Find the Fourier coefficients(a_0, a_n, and b_n) of $f(x)$. [11 marks]

(d) Find its Fourier series expansion. [2 marks]

(e) To what value will the Fourier series converge by taking $x=\dfrac{1}{2}$? [2 marks]

Continued...

Question 3

(a) Find the limit of the following sequence and determine whether it is convergent or divergent.

$$a_n = \lim_{n\to+\infty} \frac{2n^3+5n}{n^4+4n+8}$$ [3 marks]

(b) Determine thefollowing seriesis convergence or divergence. (Hint: use Ratio Test)

$$\sum_{n=1}^{\infty} \frac{(-6)^n}{(n+1)!}$$ [6 marks]

(c) Determine the radius and interval of convergence atthe following power series.

(i) $\sum_{n=0}^{\infty} \frac{1}{(n+1)!} x^n$ (ii) $\sum_{n=0}^{\infty} n! x^n$ [11 marks]

Question 4

(a) Let $z = \dfrac{2+i}{2-2i}$ and $w = \dfrac{2-3i}{2+2i}$,find $z+w$ and$z-w$. [4 marks]

(b) Given that z = -1+4i, determine the square roots of z. [4 marks]

(c) Given that vectors $\mathbf{a} = \hat{\mathbf{i}} + 2\hat{\mathbf{j}} - 3\hat{\mathbf{k}}$ and $\mathbf{b} = 2\hat{\mathbf{i}} + \hat{\mathbf{j}} + 2\hat{\mathbf{k}}$ respectively.

(i) Find the vector productof $\mathbf{a} \times \mathbf{b}$. [3 marks]

(ii) Find the dot product of $\mathbf{a} \cdot \mathbf{b}$ and the angle between **a** and **b**. [4 marks]

(d) Let $A(0,2,1)$, $B(1,-2,3)$ and $C(1,0,1)$ be the three points on a plane. Find the equation of a plane that contains those points. [5 marks]

Continued...

Question 5

(a) Find $\dfrac{\partial^2 f}{\partial x^2}, \dfrac{\partial^2 f}{\partial y^2}$ and $\dfrac{\partial^2 f}{\partial x \partial y}$ for the function $f(x,y) = 4x^2 + 2y^2 + \dfrac{1}{x^2}e^{2y}$.

[5 marks]

(b) (i) Find an equation of tangent plane to the following function,

$z = \sqrt{8 - 4x^2 - y^2}$ at the given point (1, 0). [5 marks]

(ii) Use the answer of part (i) to approximate $f(0.95, -0.05)$. [1 marks]

(c) Use Lagrange multipliers to find the maximum of the following function subject to the given constraint.

$f(x,y) = x^2 + 6y^2$; $2x - y = 2$. [9 marks]

End of Paper